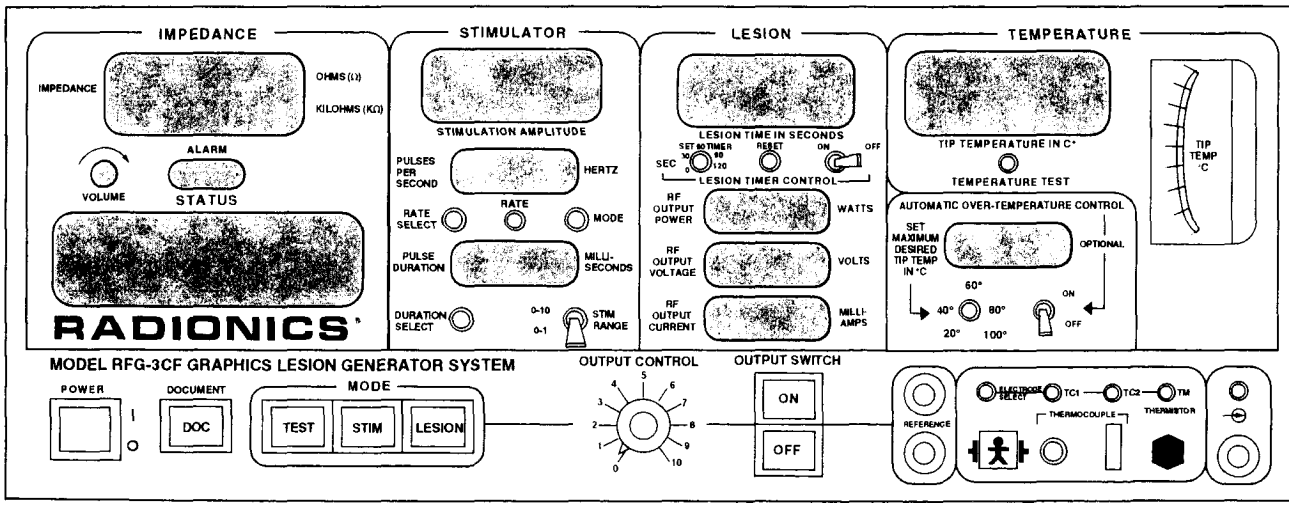
RFG-3CF
LESION GENERATOR
SERVICE
MANUAL



RADIONICS, INC.

914-60-001 Rev. A

TITLE AND PUBLICATION NUMBER:
RFG-3CF Lesion Generator Service Manual
914-60-001 Rev. A

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Radionics, Inc.
22 Terry Avenue, Burlington MA 01803, USA

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RFG-3CF Radio Frequency Lesion Generator is a registered trademark of Radionics. All tradenames referenced are the trademarks, registered trademarks, or products of their respective manufacturers.

RADIONICS is a trademark of Radionics, Inc.

CE The RFG-3CF (914) is compliant with the European Council Directive 89/336/EEC concerning electromagnetic compatibility.

FCC STATEMENT CONCERNING RFI
The RFG-3CF Lesion Generator generates and uses radio-frequencies. The equipment may cause interference with other medical equipment in the vicinity.

If interference occurs, one or more of the following measures could remedy the problem:

- Move the generator away from the affected equipment.
- Plug the generator into a separate outlet so that it is on a different branch circuit.

If necessary, consult the manufacturer of the affected equipment or an experienced technician. In addition, the booklet "How to Identify and Resolve Radio-TV Interference Problems" may be helpful. This booklet is published by the FCC and available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-00-00345-4.

LIMITED WARRANTY
Radionics warrants to the original purchaser that the equipment listed in the Operator's Manual shall be free from defects in material and workmanship for a period of 1 year from the date of shipment. Radionics' obligation under this warranty shall be limited to repair or replacement, at the option of Radionics Inc. The above warranty is contingent upon normal usage and does not cover products that have been modified without Radionics' approval or which have been subjected to unusual physical or electrical stress.

Temperature Monitoring Electrodes
Since electrodes are more subject to abuse the warranty differs. Barring mistreatment and misuse, if the electrode fails in the first three (3) months after date of shipment it is replaced free of charge; if it fails within three (3) to six (6) months it is replaced at 50% of its cost; and if it fails between six (6) to nine (9) months, it is replaced at 75% of its cost. Thereafter RADIONICS discontinues its warranty. We note that with proper care TM and TC electrodes have and should function for many years. A common problem is that the insulating coating may have been scraped, in which case it can be recoated at RADIONICS at a modest cost.

European Representative: RADIONICS Europe N.V.
Gentsesteenweg 40
B-9230 Wetteren BELGIUM

European Communities Council Directive 89/336/EEC
Concerning Electo Magnetic Compatibility

DECLARATION OF CONFORMITY

The undersigned, being this company's designated person established in the European Community, declares that the products named and listed on this certificate meet the provisions of this Council Directive which apply to them and the CE Mark may be affixed.

General Product Name: Model RFG-3C Graphics RF Lesion Generator System

Plant of Manufacture: RADIONICS INC.
22 Terry Avenue
Burlington, Ma. 01803 USA

Intended Use: RFG-3C is indicated for use in Neurology, Orthopedics, Podiatry, and for animal study.

Conformance to: EN 60601-1-2:1993 EN 60601-1:1988
EN 60601-2-2:1991

First Compliant Serial No.: 912-001

Year of Manufacture: 1996

Directive Classification No: Class 1 Type BF Defibrillator Protected

Manufacturer
Signature
William J. Rittman III
Full Name
Vice President
Position
Burlington, Ma. USA 5/3/96
Place Date

European Legal Representative
Signature
William J. Rittman III
Full Name
Director
Position
Wetteren, Belgium 5/3/96
Place Date

3CDCLARE.DOC

Dear Valued Customer,

Thank you for buying the RFG-3CF Lesion Generator. The RFG-3CF is a modern microprocessor controlled unit designed to provide the ultimate in safety and performance.

Radionics is a world leader in the manufacture of advanced medical instruments in the fields of neurosurgery, pain relief, and radiation therapy.

The Radionics equipment line is world renowned for its reliability, functionality, and high quality. Its products and developments involve extremely advanced technology which continues to be created by its in-house team of scientists and engineers. The Radionics companies have attained substantial dominance in the fields of Radiofrequency lesioning, based on superior quality of products. Radionics is proud of the diversity and breadth of its product spectrum in the key medical areas and its on-going leading-edge research and development.

Service

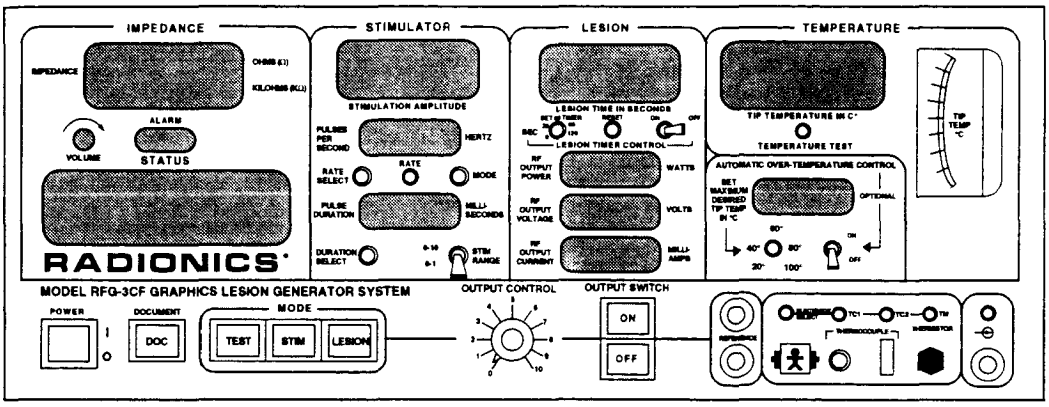
If the generator does not function properly during any of the tests described in this manual, do not attempt to use the device. Call Radionics Customer Service (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

To ensure accuracy of unit output and displays, the unit should be returned to Radionics annually for calibration.

In case of failure or malfunction of the device, do not use the device. Report the type of problem you experienced immediately to Radionics.

If there is evidence of any electrical malfunction, accident, misuse, alteration, or other damage to the generator, please return the unit to Radionics with a problem description.

Section 1
Caution, Note



Caution

The RFG-3CF is not user-serviceable. Opening the unit may void the warranty.

If the generator does not function properly during any of the tests described below, do not attempt to enter or use the device. Call Radionics customer service at (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

The following test accessories are needed to perform the tests listed below:

Part Description	**Radionics P/N**
TC1 Test Probe	910-19-600283
TC2 Test Probe	910-19-600265
TM Electrode	SRK/14-TM
C104 Cable for TM Electrode	C104-TM
470Ω load $^1/_2$W resistor	R05 X2 4700
RS 200 Resistance Substituter	IET Labs Inc.™ RS200
100Ω 70W Non-Inductive Resistor	R05-70-1000
Calibrated water baths @ 40°C and 90°C	

Note

If you do not possess any of the above listed items, these can be purchased from Radionics Sales at (USA) 1-800-466-6814.

If any technical questions arise, call technical support at (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

Section 2
Testing the RFG-3CF

Before Testing

After unpacking the RFG-3CF from the shipping box, plug the power cord into the rear of the unit.

Make sure that the wall outlet voltage and frequency match those on the serial number label on the rear of the unit.

Plug the power cord into the proper AC receptacle. Rotate the RFG-3CF's carrying handle downward by pressing the buttons on both sides of the unit. The handle will lock into a number of different positions to allow it to be used as an adjustable tilt stand as well as a carrying handle. Adjust this handle for easy viewing of the front panel.

Analog Meter Zero

Verify the unit is shut down when the generator's power is OFF. Verify the analog Temp meter goes to 20°C and does not stay in an arbitrary position (e.g., above or below the 20°C point).

If the Temp meter indicator is slightly above or below the 20°C mark, adjust the meter's zero indicator screw located on the face plate to read 20°C. **This adjustment must be made with the generator OFF.**

Check Line Fuse Value

Check the value of the line fuses (2). They should be T 3.0 AMP 250 V Slow-Blow fuses for 100-120 VAC units, and T 1.6 AMP 250 VAC for 220-240 VAC units.

Lights and LEDs

Turn the generator ON. Exercise all the unit's functions. Observe that the LED segments that are part of one group and the lights on the corresponding buttons illuminate with approximately the same intensity and no LEDs or LED segments are out.

Digital Impedance Meter Check
Impedance Calibration Verification

Test Mode ON

The internal test resistance is 100 ohms. Whenever the Test button is pushed, the Status window will display TEST MODE ON, select Mode and the Impedance window will display 100 ohms ±20%.

Test Mode OFF

The RFG-3CF continuously measures the impedance between a selected electrode and the dispersive connection. The appropriate ohms (Ω) or kilo-ohms (kΩ) LED will light. If the measured impedance exceeds 5,000 ohms, the Impedance window will display dashes (---), and the Status window will display OUTPUT OPEN CIRCUIT. There is also an audible tone that is proportional to impedance when not in lesion mode (in lesion mode the tone is proportional to the temperature). The volume of this tone can be adjusted by turning the Volume knob under the Impedance display window.

Set the generator output to minimum. Check the following impedance measurements across the output with a resistance substituter (decade box).

Caution:	Do not increase output when connected to resistance substituter. Damage to the substituter will occur.

Select Mode		*Lesion Mode*	
• Impedance @ 100Ω (95-105)	_____	• Impedance @ 100Ω (95-105)	_____
• Impedance @ 500Ω (475-525)	_____	• Impedance @ 500Ω (475-525)	_____
• Impedance @ 1000Ω (950-1050)	_____	• Impedance @ 1000Ω (950-1050)	_____
• Impedance @ 2000Ω (1900-2100)	_____	• Impedance @ 2000Ω (1900-2100)	_____
• Impedance @ 3000Ω (2850-3150)	_____	• Impedance @ 3000Ω (2850-3150)	_____
• Impedance @ 4000Ω (3800-4200)	_____	• Impedance @ 4000Ω (3800-4200)	_____
• Impedance @ 5000Ω (4750-(---)	_____	• Impedance @ 5000Ω (4750-(---)	_____

If the generator does not comply with the tolerances established above, do not attempt to service or use the device. Call Radionics Customer Service (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

Audio Tone and Volume

Turn up the volume control. Press the Temp Test button and listen for 40°C and 90°C tone. Verify the tone increases with temperature. In Output open circuit (Select Mode), verify the audio tone is high with open circuit, and low with Test Mode ON. Audio tone should be at a very low level when the volume control knob is at minimum.

Stimulator Mode

Set the Output Control knob to zero. Press the Stim button and verify it illuminates. The Stimulator section should illuminate and display 0-.02 volts, 50 Hz rate, and a 1.00 mS duration. The Status window should display VOLTAGE STIMULATOR, OUTPUT OPEN CIRCUIT. Press the ON button. The ON button will light, the rate LED will flash, and the Status display will read VOLTAGE STIMULATOR, STIM OUTPUT ON. With the output attached to a 470Ω load resistor and an oscilloscope across the load, verify that the rate, pulse width, and amplitude are within 10% of the displayed readings in the 0-1 and 0-10 volt ranges. Select Current Stim by depressing the Mode button. The mA LED will be illuminated in the Stim Amplitude window. The Output Control Knob does not have to be set to zero. Press the ON button. The ON button will light, the Rate LED will flash, and the Status Display will read "CURRENT STIMULATOR, STIM OUTPUT ON". With the output attached to a 470Ω load resistor and an oscilloscope across the load, verify that the rate, pulse width, and amplitude are within 10% of displayed readings in the 0-1 and 0-10 mA ranges. Remove all cables from the generator.

Lesion Mode

Select Lesion mode. Set the Output Control knob to minimum (fully counter-clockwise). The Status display will read OUTPUT OPEN CIRCUIT, LESION MODE READY. Connect a 100Ω 70W non-inductive resistor across the output of the generator. Verify the Lesion Timer Control is adjustable from zero to 120 seconds ±2 seconds. Set the Lesion Timer Control for 60 seconds and turn the timer switch on. Select Output ON (Status display will read LESION MODE, LESION OUTPUT ON) and verify the accuracy of the timer is within one second. Verify the RF Output Power displays zero when the RF output is at minimum.

Check the output waveform for amplitude and frequency by attaching an oscilloscope across the 100Ω load. Set the Output Control knob to minimum. The amplitude will be .5 to 1 volt (peak to peak). When the Output Control knob is at maximum, the amplitude will be 110 to 120 volts peak. The output will be a pulsing sinusoidal waveform at a frequency of 450 to 550 KHz, and a duty cycle of 80%. The generator output will read approximately 70 volts, 700 milliamps, and 50 watts.

If the generator does not comply with the tolerances established above, do not attempt to service or use the device. Call Radionics Customer Service (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

Temperature TC/TM

You will need a TC1, TC2 and a TM type probe, a calibrated temperature meter, and water baths set at 40°C and 90°C respectively (measure and record the temperatures of the water baths for accurate comparison).

Start with the TC1 probe, measuring the two temperature baths and verifying that the displayed temperature is within ±2°C of the bath temperatures recorded using the temperature meter. Repeat the measurements for TC2 and TM probes, verifying that the displayed temperatures are within ± 2°C of the measured bath temperatures. (To select a different electrode port, press the electrode select button.)

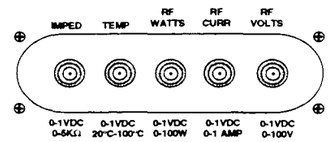
Press the Temp Test button while in TC1 mode. Verify the temperatures are within 2°C of 40°C and 90°·C. Repeat the temperature test for TC2 and TM modes and verify the temperatures remain within ±2°C of the temperature baths. Press the Temp Test button again (regardless of the electrode port selection) and verify the analog meter is within ±2°C of the digital display. Press the Test Mode button, turn the output ON, and increase the output control. Verify the test load temperature increases. Switch between the electrode ports and verify the TC and TM temperature functions are within ±3°C of each other.

OTC- Over Temperature Control

The OTC or Over-Temperature Control prevents the selected electrode tip temperature from exceeding the preset temperature displayed in the over-temperature control window. If this temperature is exceeded, the amplitude of the RF power is reduced slightly. This is achieved by a feedback mechanism that will tend to regulate the temperature at the preset value. However, this is only true if the power is set high enough by the operator to achieve this temperature and is not set so high that the temperature reads greater than 5°C higher than the set temp. If the latter occurs, the status will display power set too high, and the alarm will sound until the output has been reduced to a limit that will maintain the set temperature.

The Over-Temperature Control can be set between 20°-100°C by turning the Set Temperature knob. Please note that the OTC circuit is activated only if the OTC toggle switch is in the ON position. If it is in the OFF position, the set temperature window is blank, and the operator must manually adjust the Output Control knob in order to maintain a desired temperature.

Analog Outputs



Analog outputs are supplied on the rear of the RFG-3CF for Impedance, Temperature, RF Watts, RF Current, and RF Volts. The outputs are adjusted to 1 volt DC for full scale reading; this is a standard input for most chart recorders. Most chart recorders have adjustments to set both zero and full scale readings. For example, to calibrate the impedance recorder, turn the unit on and short the electrode to the dispersive jack. The impedance should read approximately 00. IMPORTANT **Notice:** DO NOT TURN THE RF UP IN THIS CONDITION. DAMAGE TO THE RF SECTION COULD RESULT. Connect the chart recorder input to the BNC connector on the back of the RFG-3CF. Adjust the zero adjust on the chart recorder so the pen points to the zero location on the paper. Remove the short. The Impedance display should read "--". Adjust the chart recorder gain control so the pen points to the full scale location on the paper. The chart recorder is now adjusted for use with the impedance output. The same must be done for each output that is to be recorded.

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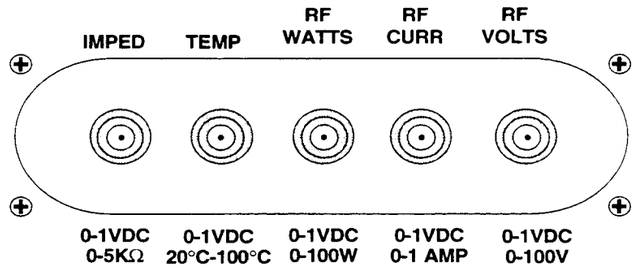
Section 3
BNC Chart Recorder Calibration



The following equipment is needed for this calibration:

one RS-20 resistance substituter
one C121 black reference cord
one lesioning electrode and cable

Procedure

If the generator does not function properly during any of the tests described above, do not attempt to use the device. Call Radionics customer service at (USA) 1-800-466-6814.

Impedance

1. Connect the chart recorder to the IMPED BNC connector on the back of the RFG-3CF.
2. Connect the electrode and reference cords to their respective front panel jacks.
3. Connect the ends of the cords together. **CAUTION: DO NOT TURN THE RF ON WHILE THE CORDS ARE SHORTED.**
4. Turn the RFG-3CF and the chart recorder on.
5. Adjust the chart recorder zero control until the pen reads zero.
6. Connect the electrode and reference leads from the unit to the resistance substituter, set to 5kΩ.
7. Adjust the chart recorder gain control for full scale reading.
8. Remove both of the cords.

Temperature

1. Connect the chart recorder to the TEMP BNC connector on the back of the RFG-3CF.
2. Press the TEMPERATURE TEST button on the front panel.
3. When the temperature display reads 40°C, adjust the chart recorder zero for the position that you want the 40° line.

4. When the temperature display reads 90°C, adjust the chart recorder gain for the position that you want the 90° line.

Watts

1. Connect the chart recorder to the WATTS BNC connector on the back of the RFG-3CF.
2. Adjust the chart recorder zero control until the pen reads zero.
3. Press the TEST button on the front panel of the unit to put the unit into test mode.
4. Press the LESION button to put the unit into lesion mode.
5. Switch the timer ON/OFF switch to the OFF position.
6. Turn the OUTPUT CONTROL knob to zero and press the ON button.
7. Turn the OUTPUT CONTROL knob up slowly until the WATTS display reads 40.
8. Adjust the chart recorder gain control until the pen is where you desire 40 watts (near full scale).
9. Turn the OUTPUT CONTROL knob to zero.

Current

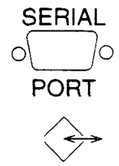
1. Connect the chart recorder to the CURRENT BNC connector on the back of the RFG-3CF.
2. Turn the chart recorder zero adjust until the pen reads zero.
3. Turn the OUTPUT CONTROL knob up until the Current display reads 500mA.
4. Adjust the chart recorder gain control until the pen reads half scale.

Volts

1. Connect the chart recorder to the VOLTS BNC connector on the back of the RFG-3CF.
2. Adjust the chart recorder zero control until the pen reads zero.
3. Adjust the OUTPUT CONTROL knob until the volts display reads 50V.
4. Adjust the chart recorder gain control until the pen reads half scale.

Section 4
Serial Output

Serial Output



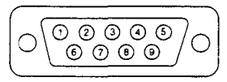
A serial output is provided on the back of the unit. This output conforms to the RS232C serial output configurations. If a LaserJet™ printer is serially connected to the 9-pin output connector on the back of the unit, a graph of the front panel settings versus time can be printed. This is done by pressing the DOC button after a timed lesion has been made.

Note: The printer must use the HP PCL command set and have a serial port (not continuous or parallel).*

The following printers have been tested with this unit.

1. HP LaserJet
2. HP LaserJet IIP
3. HP LaserJet IIP Plus (with optional serial interface)
4. Okidata 830 in HP emulation (with optional serial interface)

The connector is configured as shown below.



2 TXD
3 RXD
5 SG
All other pins not used.

HP is a registered trade mark of Hewlett Packard

If the generator does not comply with the tolerances established in this manual, do not attempt to service or use the device. Call Radionics Customer Service (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

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Section 5
Specifications
Electrical Safety Information

Specifications for the RFG-3CF Lesion Generator

ELECTRICAL SUPPLY

Voltage Specifications:

Volts (customer specified)	Volts input range
100Vac	90-110
117Vac	105-125
220Vac	200-240
240Vac	220-260

Maximum input voltage:	260Vac
Maximum voltage on any output connector:	260Vac
Maximum input power:	416VA
Supply current:	3.0 AMP ~ alternating current sinusoidal wave (117V units) 1.6 AMP ~ alternating current sinusoidal wave (220V units)
Fusing:	3.0 AMP (T) Time-lag (117V units) Domestic 1.6 AMP (T) Time-lag (220/240V units) Foreign
Frequency:	50/60 Hz

ENVIRONMENT OPERATING RANGE

Temperature:	50°F-86°F
Humidity:	20%-80% Non-condensing relative humidity

IMPEDANCE MONITOR

Range:	0-5000 ohms digital
Resolution:	1 ohm
Accuracy:	10% of full scale

STIMULATOR OUTPUT

Rate:	ONE SHOT, 2, 5, 10, 20, 50, 75, 100, 150, 180, 200 Hz
Duration:	.1, .2, .5, 1 ms
Amplitude selectable:	
Voltage stim mode:	0-1 volt 0-10 volts
Constant Current Stim mode:	0-1 mA 0-10 mA

RF LESION GENERATOR OUTPUT

Timing:	Selectable:	0-120 seconds
	Accuracy:	.25 second
	Resolution:	±1 second
Volts:	0-100 V	
	Accuracy:	10% of full scale
	Resolution:	±1 volt
Current:	0-999 mA	
	Accuracy:	10% of full scale
	Resolution:	1 mA

Watts: 0-50 watts Max. (40 watts min. into 100Ω load)
Accuracy: 10% of full scale
Resolution: .1 watt
Frequency: 500k Hz ± 10%

TEMPERATURE MONITOR

TC1, TC2, and TM drift less than ±2° from ambient temperature

OVER-TEMPERATURE CONTROL

Range: TC1, TC2, and TM 20-100°C
Resolution: ±1°C

OUTPUT JACKS (BNCs on back panel)

RF Volts	0-100 RF volts	0-1 Vdc +/-20% FS
RF Current	0-1000 RF mA	0-1 Vdc +/-20% FS
RF Watts	0-50 RF watts	0-.5 Vdc +/-20% FS
Impedance	0-5000 ohms	0-1 Vdc +/-20% FS
Temperature	20-100°C	0-1 Vdc +/-20% FS

Notice: The above voltages are nominal since exact calibration is achieved by adjusting the offset and gain controls on the recording device to which this is connected.

Electrical Safety Information

The RFG-3CF has been designed to comply with the requirements and standards of the international electrical safety codes. Special isolation transformers are imposed between power lines and internal RFG-3CF circuitry, resulting in very low leakage current.

The RFG-3CF has been designed to meet UL 544, IEC 601-1, IEC 601-2, IEC 601-2-2, and IEC 801, and is designated Class 1 Type BF equipment. This means it was designed to be patient connected. The patient applied part is isolated from earth at high frequencies. The RFG-3CF has been designed for continuous commercial service (CCS) operation, even though such service is not contemplated. Only Radionics type electrodes and cables should be used with the RFG-3CF to ensure function, safety, and calibration. All electrodes and cables are designed to maximize accuracy and minimize errors due to high and low frequency leakage currents. The dispersive electrode should be reliably attached with its entire area to the patient's body and as close to the operating field as possible.

Warning: Needle electrodes should not be used for the dispersive electrode as it is possible to burn the patient at this site due to high current densities.

In all electrosurgical applications, care should be taken to maximize the surface area of the dispersive electrode. The RFG-3CF is a radio frequency lesion generator designed to produce local tissue heating at the tip of an electrode by presence of radio frequency current.

Local dealer telephone number _____.

Section 6
Troubleshooting

Troubleshooting

PROBLEM	*POSSIBLE CAUSE*
Unit will not turn on	Bad AC outlet
	Defective power cord
	Blown fuses
No output	Unit in TEST MODE
	No ground connection
	Problem with catheter
	Break in electrode cable
	Bad electrode
	Wrong electrode selected
No impedance readings	No ground connection
	Open circuit in cabling
RF output will not turn on	Time set to zero
	Output control set to a value other than zero
	Automatic Impedance Cutoff is set lower than tissue impedance
Power shuts down prematurely	Set time on the timer is too low
No response when a button is pressed	Press button deliberately in the center of its lens cap. It is possible for a rapid off center push to not register.
	Check to ensure no button is stuck in the depressed position.
No temperature reading	Not using temperature monitoring electrode.
	Bad cabling (can be verified if RFG-3CF passes TEMPERATURE TEST)
Stimulator voltage too low	Range switch in low position
Stimulator will not turn on	Output control off zero
Lesion output power low and alarm sounds	OTC set too low

A COMMON PROBLEM THAT OCCURS DURING TRIGEMINAL NEURALGIA (TIC) PROCEDURES IS THE PATIENT MAY EXPERIENCE A STIMULUS EVEN WHEN THE GENERATOR IS UNPLUGGED FROM THE POWER SOURCE.

This occurs because the patient acts as an electrolyte, and when two plates of dissimilar metals (electrode and ground pad) are attached, a battery is formed. If a discharge path is connected across this voltage, the charge carriers present will flow through it, discharging the potential. This is the case when a lesion generator is connected across a patient via an electrode and ground plate. This discharge action may stimulate the patient if near the trigeminal nerve.

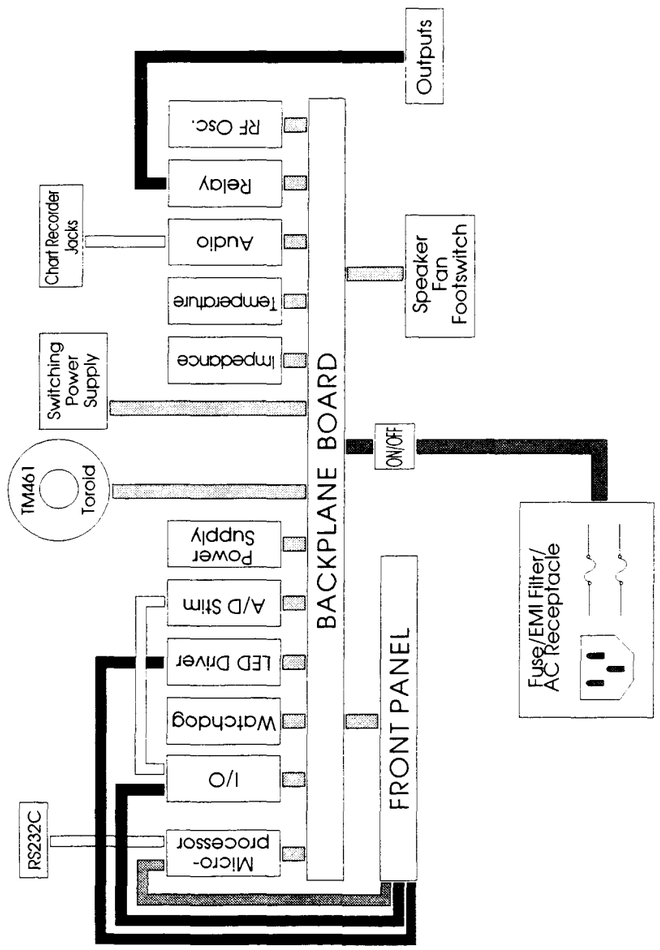
Using an electrode and ground plate composed of the same metals will remedy this. No significant charge develops across them when connected to the patient, and no current flows when connected to the generator.

Radionics, Inc. will supply, by request, a stainless steel ground pad [Radionics part number RFG-GP] or disposable ground pads for use with Radionics electrodes.

If unable to resolve the problem, do not attempt to service or use the device. Call Radionics Technical Support at (Europe) 32 93/66.10.19 or (USA) 1-800-466-6814.

Section 7
Block Diagram

Block Diagram of the RFG-3CF



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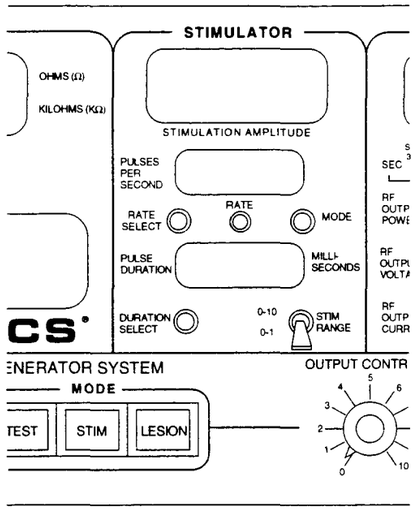
Section 8
Stimulator Mode



Test Mode Off

The stimulator is selected by depressing the yellow STIM mode button.

Voltage or Current stimulation mode is selected by depressing the MODE button. The "V" or "mA" LED will illuminate, indicating which mode is selected.

The pulse amplitude is displayed in the Stimulator Amplitude window. It is increased by turning the Output Control knob clockwise.

The pulse frequency is indicated in the Pulses Per Second window and is changed by pushing the Rate Select button below the Rate window. When the stimulator is activated, the RATE light flashes at the selected rate as an indicator that the stimulator is working.

The pulse duration is indicated in the Pulse Duration window and is changed by pushing the Duration Select button directly below the window. Selecting the One Shot mode will send a single pulse to the output each time the stimulator is activated. One Shot mode is selected by depressing the RATE SELECT button until dashes are displayed in the Pulses Per Second window.

The stimulator is activated by depressing and holding down the footswitch while in STIM mode. The microprocessor prevents the stimulator from being turned on when in Voltage Stimulation mode without first setting the Output Control knob to zero.

The stimulator can be turned on independent of the Output Control Knob position when Current Stimulation mode is selected.

Notice: It is important to note that the readings of the stimulator voltage or current, pulse frequency and pulse duration all indicate their respective settings only. A value shown for pulse amplitude does not mean an output is being produced. ***The status window will display STIM OUTPUT ON and the rate light will flash when a stimulus is sent to the output.***

Notice: In Current Stimulation mode, dashes are displayed indicating the impedance is too high to maintain a constant current. This can be corrected by lowering the stimulation current.

Test Mode On

The functions are identical as described above, except the output is directed to a 100 ohm internal test resistor instead of the selected electrode jack.